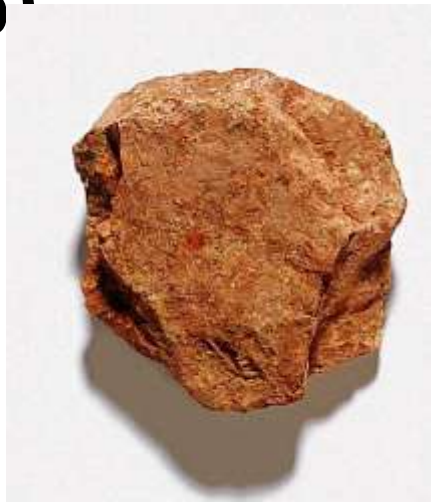
Bell Work
7-Feb-2017

Balance the following equation;

$\_Al + \_O_2 \rightarrow \_Al_2O_3$

How many moles **of Aluminum Oxide are produced from the combustion of 3 moles of Aluminum (think about the balanced equation and a molar ratio)**

What about grams of O_2 needed?



Objective:

You will be able to set up a mole bridge using a balanced equation.

EQ: How does being confident in only part of a very large number impact results

Stoichiometry

Stoichiometry

Balance the following equation:

$$4\ NH_3 + 5\ O_2 \rightarrow 6\ H_2O + 4\ NO$$

What is the ratio between ammonia and nitrogen monoxide? **4:4 or $\frac{4 mol\ NH_3}{4 mol\ NO}$**

What is the ratio between Nitrogen monoxide and oxygen? **4:5 or $\frac{4\ mol\ NO}{5\ mol\ O_2}$**

So for every 4 mol of NO you have 5 mol of O_2.

Stoichiometry

$$4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$$

So many conversion factors exist:

4 mol NH_3/5 mol O_2, 6 mol H_2O/4 mol NH_3, etc

What if you had 2 mol of NO, how many moles of O_2 would you have?

$$2\text{mol NO} \times \frac{5\text{mol } O_2}{4\text{mol NO}} = 2.5\text{mol } O_2$$

What if you had 6 mol of H_2O, how many moles of O_2 would you have?

$$6\text{mol } H_2O \times \frac{5\text{mol } O_2}{6\text{mol } H_2O} = 5\text{mol } O_2$$

Stoichiometry

“Stoichiometry” refers to the relative quantities of moles. It also refers to calculations that make use of mole ratios.

Stoichiometry

$$4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$$

Recall also that molar masses provide factors:

$$\frac{1 \text{ mol } NH_3}{17 \text{ g } NH_3} \qquad \frac{32 \text{ g } O_2}{1 \text{ mol } O_2}$$

Is $\frac{4 \text{ g } NH_3}{5 \text{ g } O_2}$ **a conversion factor?**

No!

The equation tells us moles not grams.

Stoichiometry Question 1a

Consider : $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

How many moles of H_2O are produced if 0.176 mol of O_2 are used?

$$\#\ \text{mol } H_2O = 0.176\ \text{mol } O_2 \times \frac{6\ \text{mol } H_2O}{5\ \text{mol } O_2} =$$

$$0.21\ \text{mol } H_2O$$

Notice: A correctly balanced equation is essential to get the right answer

Stoichiometry questions (1b)

Consider : $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

How many moles of NO are produced in the reaction if 17 mol of H_2O are also produced?

mol NO= $17 \text{ mol } H_2O \times \frac{4 \text{ mol NO}}{6 \text{ mol } H_2O} =$

11.33 mol NO

Notice: A correctly balanced equation is essential to get the right answer!

Recall

What is essential to perform stiochiometry?

Stoichiometry questions 1c

Consider : $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

How many moles of NH_3 are needed in the rxn if 0.5 mol of H_2O are also produced?

$$\#\ \text{mol } NH_3 = 0.5\ \text{mol } H_2O \times \frac{4\ \text{mol } NH_3}{6\ \text{mol } H_2O}$$

= 0.33 mol NH_3

This is what anhydrous ammonia will do to your skin

The "Mole Bridge"

The Mole Bridge is used to convert from one type of compound to another via their molar ratio based on a *Balanced* equation.

You have just converted from one type of compound to another in moles.

Now what if you wanted to go from moles of one compound to grams of another?

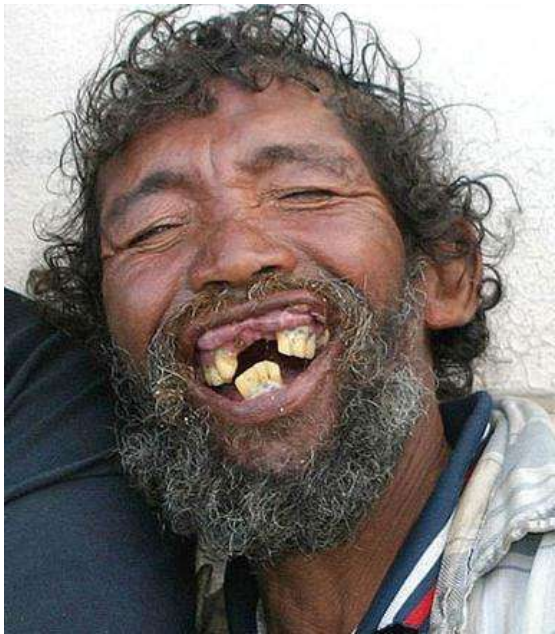
The "Mole Bridge"

Now what if you wanted to go from moles of one compound to grams of another?

Moles of A → grams of B

$$\text{mol A} \times \frac{\text{mol B}}{\text{mol A}} \times \frac{\text{Molar Mass B}}{1\ \text{mol B}} = \text{grams B}$$

The Mole Bridge



Your Turn

Consider : $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

How many grams of H_2O are produced if 1.9 mol of NH_3 are combined with excess oxygen?

$$\#\ g\ H_2O = 1.9\ \text{mol } NH_3 \times \frac{6\ \text{mol } H_2O}{4\ \text{mol } NH_3} \times \frac{18\ g\ H_2O}{1\ \text{mol } H_2O} =$$

51 g H_2O

Your Turn

Consider : $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

How many grams of O_2 are required to produce 0.3 mol of H_2O?

$$\#\ g\ O_2 = 0.3\ \text{mol } H_2O \times \frac{5\ \text{mol } O_2}{6\ \text{mol } H_2O} \times \frac{32\ g\ O_2}{1\ \text{mol } O_2} = \mathbf{8\ g\ O_2}$$